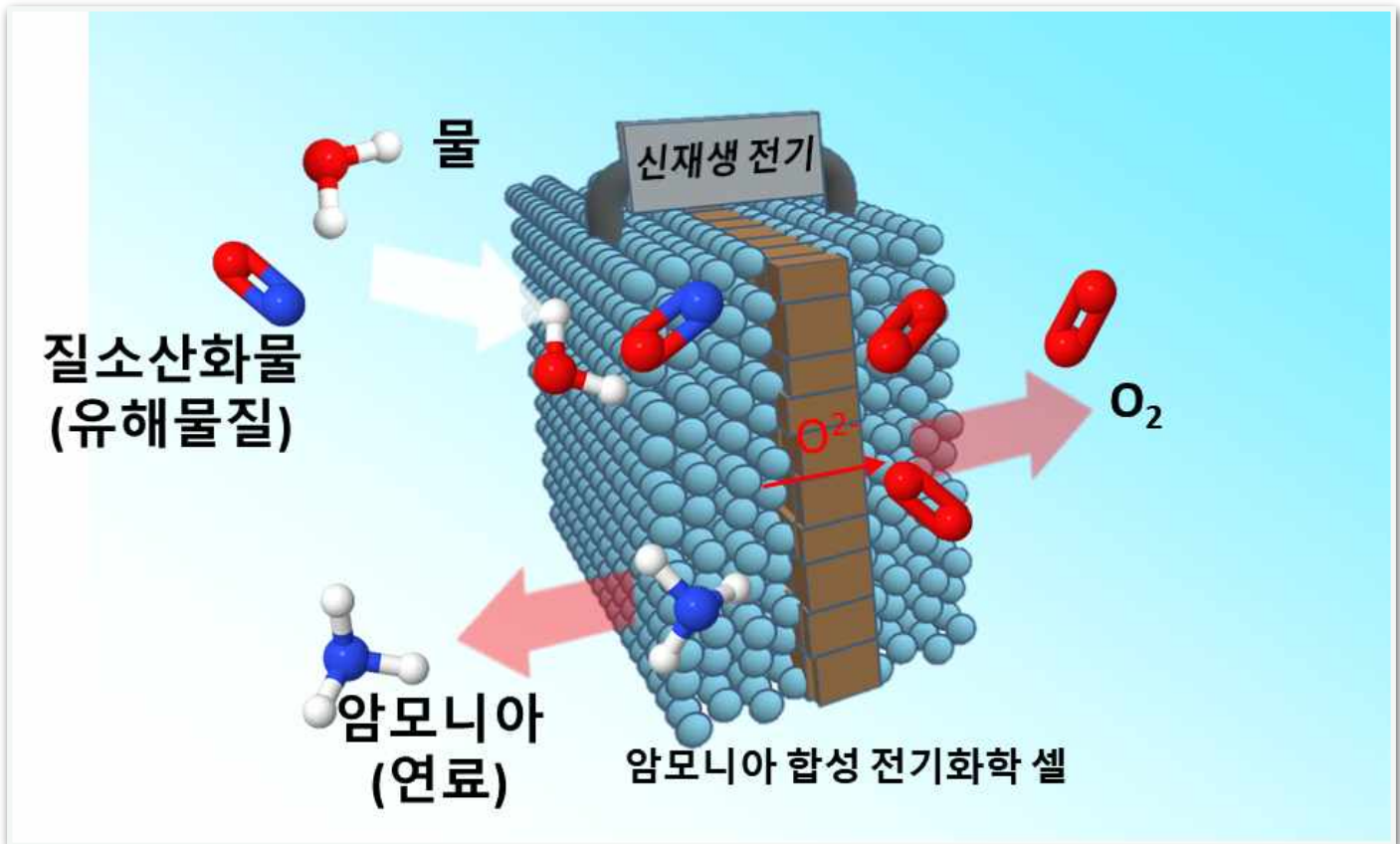


Development of technology to convert environmental pollutants into ammonia

- Production of ammonia, as hydrogen storage, with high efficiency by using an electrochemical cell



▲ Schematic diagram of an electrochemical cell that converts fine dust-causing substances into ammonia fuel

A technology has been developed to convert nitrogen monoxide, a representative environmental pollutant that causes fine dust and acid rain, into ammonia.

GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Earth Sciences and Environmental Engineering Professor Jong Hoon Joo' research team developed a technology to convert nitrogen monoxide into ammonia, as hydrogen storage, through joint research with Dr. Hyung Chul Yoon's team at the Korea Institute of Energy Research.

Ammonia is well known as a raw material for fertilizers, but it has recently been spotlighted as an important material for responding to climate change. In particular, it is easy to serve as a hydrogen carrier that stores and transports hydrogen to realize carbon neutrality, and it is attracting attention as an alternative fuel because it does not generate CO₂ during combustion.

Currently, the Haber-Bosch method, which is a commercialized ammonia production method, requires a high-pressure environment, consumes a lot of energy, and uses hydrogen as a fuel, which is expensive.

The existing electrochemical conversion technology succeeded in synthesizing ammonia from nitrogen, but the decomposition reaction rate of nitrogen was very slow and the efficiency of ammonia synthesis was low, so its utility was poor.

The research team succeeded in producing ammonia, a substance with high utility under atmospheric pressure, with the world's highest efficiency by using nitrogen oxide, a toxic substance in the atmosphere, as a raw material using an electrochemical cell based on a ceramic ion conductive material. In addition, hydrogen, a next-generation fuel, was produced during the process as a by-product without emitting pollutants.

The result of this study is the world's first method for synthesizing ammonia from nitrogen oxide using oxygen ion conductive material, and it has the world's highest level of production efficiency ($1885 \mu\text{mol cm}^{-2} \text{ h}^{-1}$) compared to the existing electrochemical ammonia synthesis method.

Professor Jong Hoon Joo said, "We have developed an eco-friendly and economical ammonia production technology by reducing fine dust-causing substances to produce ammonia, as hydrogen storage, with high efficiency."

This research was led by GIST Professor Jong Hoon Joo's team with participation from Dr. Hyung Chul Yoon of the Korea Institute of Energy Research with support from the National Research Foundation of Korea's Basic Research Project and the Future Hydrogen Innovation Technology Development Project and was published online on November 1, 2021, in *ACS Energy Letter* (Impact factor: 23.101, JCR top 3.7%), a renowned international academic journal in the field of energy.